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IMPLEMENTING ROTATIONAL PARTIAL REST/PATCH-BURN GRAZING IN THE FLINT HILLS, KANSAS

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The Nature Conservancy

September 30, 2008

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IMPLEMENTING ROTATIONAL PARTIAL REST/PATCH-BURN GRAZING IN THE FLINT HILLS, KANSAS
A cooperative agreement (DACA87-03-H-0015) with the Dept. of the Army, Corps of Engineers

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September 30, 2008

INTRODUCTION — The tallgrass prairie is the most altered ecosystem in North America. The Greater Flint Hills region in Kansas and part of northeastern Oklahoma has the single largest tallgrass prairie landscape left, with about 2.6 million acres of relatively unfragmented prairie remaining. The Flint Hills are also one of the last strongholds of the greater prairie-chicken. However, surveys have found the number of leks in the Flint Hills to have fallen by 50% since 1987. Fort Riley is the largest tract of publicly-owned tallgrass prairie; since 1987 its number of leks has increased. In the mid-1980's a new range management practice was implemented in the Flint Hills; i.e., annually burning in late spring, followed by intensive early stocking (IES) of cattle. Annual burning and IES is often more profitable than traditional grazing methods in the Flint Hills, but reduces the heterogeneity of the prairie. The decline of the greater prairie-chicken coincides with the introduction of IES and annual burning. Population reductions are believed to be caused by reduced cover available to nesting hens. Other grassland birds may be adversely affected as well, such as Henslow's sparrow.

Alternatives to IES include rotational partial rest and patch-burn grazing. These alternatives would leave approximately 25-66% of a pasture unburned each year. The portion burned would be rotated annually, so that over a 3 or 4 year period the entire pasture will be burned at least once. Cattle's inherent desire for the more palatable regrowth on the burned portion will reduce the time they spend in unburned pasture. Rangelands implementing both practices should provide habitat for a broader range of grassland species. Minimum size requirements of the unburned area are set at 100 acres to prevent set-aside areas from being predator traps.

The Nature Conservancy entered into a cooperative agreement (DACA87-03-H-0015) with the Department of the Army, Corps of Engineers. The agreement established the relations, responsibilities, and activities under the Department of Defense Legacy Resource Management Program for the project "Implementing Rotational Partial Rest/Patch Management in the Flint Hill Tallgrass Prairie." Purposes of the agreement were to help protect significant biological systems (tallgrass prairie) and species (emphasis on grassland birds), and establish programs for the restoration and rehabilitation of altered or degraded habitats.

BACKGROUND

Natural disturbances, such as fire and grazing, can generate patchiness across grassland landscapes, contributing to a shifting mosaic thought to enhance biodiversity. Grassland birds evolved within the context of this shifting mosaic, with some species restricted to certain patch types. As a result, range management practices that strive for uniformity may help explain recent grassland bird declines.

Periodic fire is a vital interaction for grassland health. In most of North America's remaining rangelands, fire suppression over the last century has short-circuited key processes, such as control of woody species. But in the Flint Hills, the last landscape of tallgrass prairie in North America, extensive spring pasture burning has affected ecosystem equilibrium in other ways. The impact of large areas of the Flint Hills annually burned each spring means that minimal cover for certain small mammals and ground-nesting birds are preserved during a critical time in their breeding season.

In addition to fire, many species endemic to North American prairies evolved with large grazing animals. Grazing is accepted as a keystone ecological process in grasslands. However, most rangeland management techniques were developed under the paradigm of increasing livestock production by decreasing the variability of vegetation stature, composition, density and biomass—defined as heterogeneity. Some consider heterogeneity as the foundation for biological diversity at most levels of ecological organization in grasslands (Fuhlendorf and Engle 2001), including grassland bird communities (Weins 1974). Thus, by decreasing heterogeneity, we have also negatively influenced species diversity, variety of habitats and ecosystem function. Managing for heterogeneity should serve as the starting point for conservation and ecosystem management in grasslands, because habitat for most species depends upon diverse habitat types interspersed throughout a heterogeneous landscape (Fuhlendorf and Engle 2001).

The grazing system of choice today for many ranchers in the Flint Hills is the combination of annual spring burning and intensive early stocking (IES). Soon after the new growth emerges from a spring burn, stocker cattle are introduced at a density roughly twice that of full-season grazing. After about 90 days – half the typical grazing season – cattle are shipped off to feedlots. Assuming adequate soil moisture, prairie plants have the remainder of the summer to recover from the intensive early grazing. IES results in higher net returns per acre, particularly if pastures are burned beforehand. Prior to IES, which was first implemented in the Flint Hills in the early to mid-1980s, periodic burns – about once every 3 to 4 years – and season long grazing of stocker cattle (approx. 180 days, from May to October) was the norm.

The recent combination of annual burning and IES has increased the profitability of ranching and has also reduced structural heterogeneity by removing the natural variability of vegetation. This is particularly the case during the first half of the growing season, which is the main activity season for many native grassland species. According to Zimmerman

(1996), fire and grazing are not in themselves detrimental to grassland bird reproduction, but a decline in reproductive success occurs when the two are combined in the same year.

AFFECTED FLINT HILLS CONSERVATION TARGETS: *SPECIES EMBLEMATIC OF THE SYSTEM.*

Greater prairie-chicken. Grassland bird species have shown in recent years a more consistent, widespread decline than any other bird guild monitored by the North America Breeding Bird Survey (Knopf 1994). The greater prairie-chicken (*Tympanuchus cupido*), often considered symbolic of the tallgrass prairie, is an example of this trend. Once believed relatively stable, populations in the Flint Hills—one of the last strongholds for the species—have significantly declined within the past decade, resulting in a substantial range reduction. It is critical that the Flint Hills are maintained and managed in a way that enhances the species' chances for long-term survival.

The decline of the greater prairie-chicken in the Flint Hills coincides with the introduction of IES and annual burning in the mid-1980s. The reason for the decline of greater prairie-chickens in the Flint Hills is believed to be caused, at least in part, by reduced cover available to nesting hens; there is little evidence that recent population declines are the result of cyclic fluctuations. Further, it is speculated that as greater prairie-chicken populations decline within the more intact areas of the Flint Hills, where IES and annual burning are most prevalent, an influx of birds from adjacent source habitats may restock core lekking areas, fueled by the attraction of areas with prominent lek sites but with substandard nesting habitat¹. The homogenizing effect of IES/annual burning may cause the large, untilled areas of the Flint Hills to serve as a population sink, perhaps influencing other metapopulations outside the Flint Hills.

Henslow's sparrow. One of the fastest declining songbirds in North America, Henslow's sparrow (*Ammodramus henslowii*), is also experiencing significant population decreases in the Flint Hills due to a loss of suitable habitat. While this species does not have the large area-size requirements like that of the greater prairie-chicken, it does require ungrazed or lightly grazed grassland with at least one year's accumulation of residual vegetation. High burn frequency and intensive grazing practices have likely limited its Flint Hills distribution due to a loss of suitable nesting habitat.

Increasing landscape heterogeneity is a major goal of The Nature Conservancy. Our efforts to foster more landscape heterogeneity in the Flint Hills have evolved and expanded over the past 15 years. At the Tallgrass Prairie Preserve in Oklahoma, heterogeneity has been a focus of the management plan since the preserve's initial planning in 1988. Since 1993, an expanding free-ranging bison herd has been interacting with randomly selected burn patches that reflect the original seasonality and frequency of fire. When only a portion of the area

¹ Male greater prairie-chickens establish lekking territories on high, flat areas with short vegetation and with few obstructions -- "wide open spaces". Lek locations are apparently not influenced by the availability of suitable nesting habitat. Hens prefer to nest near leks (Schroeder and Robb 1993), even if nesting habitat is less than ideal. As a result, selection of lek sites by males drives the distribution of greater prairie-chickens during the breeding season.

available to bison is burned, intense grazing of burned patches defers grazing on unburned patches, resulting in an accumulation of fuel in unburned patches. The interaction of these disturbances produces an ever shifting patch mosaic. This bison-fire regime is currently imposed upon a single 22,000-acre pasture at the Tallgrass Prairie Preserve. Research and monitoring has confirmed that this patch mosaic can successfully sustain a greater array of biodiversity.

Although the bison-fire regime has proven to be very attractive for the conservation of biodiversity, it is not highly exportable to the private ranching sector. The conservation challenge is to develop and implement cattle management regimes that incorporate some of the same “biodiversity friendly” elements as bison-fire. The Conservancy is now in the eighth year of a research partnership effort with Oklahoma State University to investigate “patch-burn grazing” (PBG) with cattle on the Tallgrass Prairie Preserve in Oklahoma. PBG is designed to approximate pre-European-settlement patterns of burning and grazing—and the interaction between the two—creating an ever-changing combination of burned and unburned, grazed and ungrazed areas, often referred to as “a shifting mosaic.” With patch-burn grazing, only a portion or patch of a pasture is burned each year (typically one-third). Results thus far are encouraging; increased heterogeneity and biodiversity can be realized with little or no decrease in livestock production. Below is a summary of weight gain comparisons between traditional IES and PBG.

**Summary of TNC-OSU Cattle Patch-Burn Study Results 2001-2007
Intensive Early Stocking with Yearling Steers (mid-April through mid-July)
Tallgrass Prairie Preserve, Osage County, OK**

Year	Control - Annual Complete Burn				Patch-Burn			
	Average In Weight (lbs)	Net Gain (lbs)	Days In	Average Daily Gain (lbs)	Average In Weight (lbs)	Net Gain (lbs)	Days In	Average Daily Gain (lbs)
2001	552	263	94	2.8	570	222	95	2.4
2002	566	265	90	2.9	592	276	98	2.8
2003	562	275	104	2.6	576	205	96	2.1
2004	550	232	108	2.2	572	252	103	2.4
2005	537	244	98	2.5	568	236	92	2.6
2006	594	258	104	2.5	613	216	100	2.1
2007	625	215	104	2.1	604	225	98	2.3
Study Averages	569	250	100	2.5	585	233	97	2.4

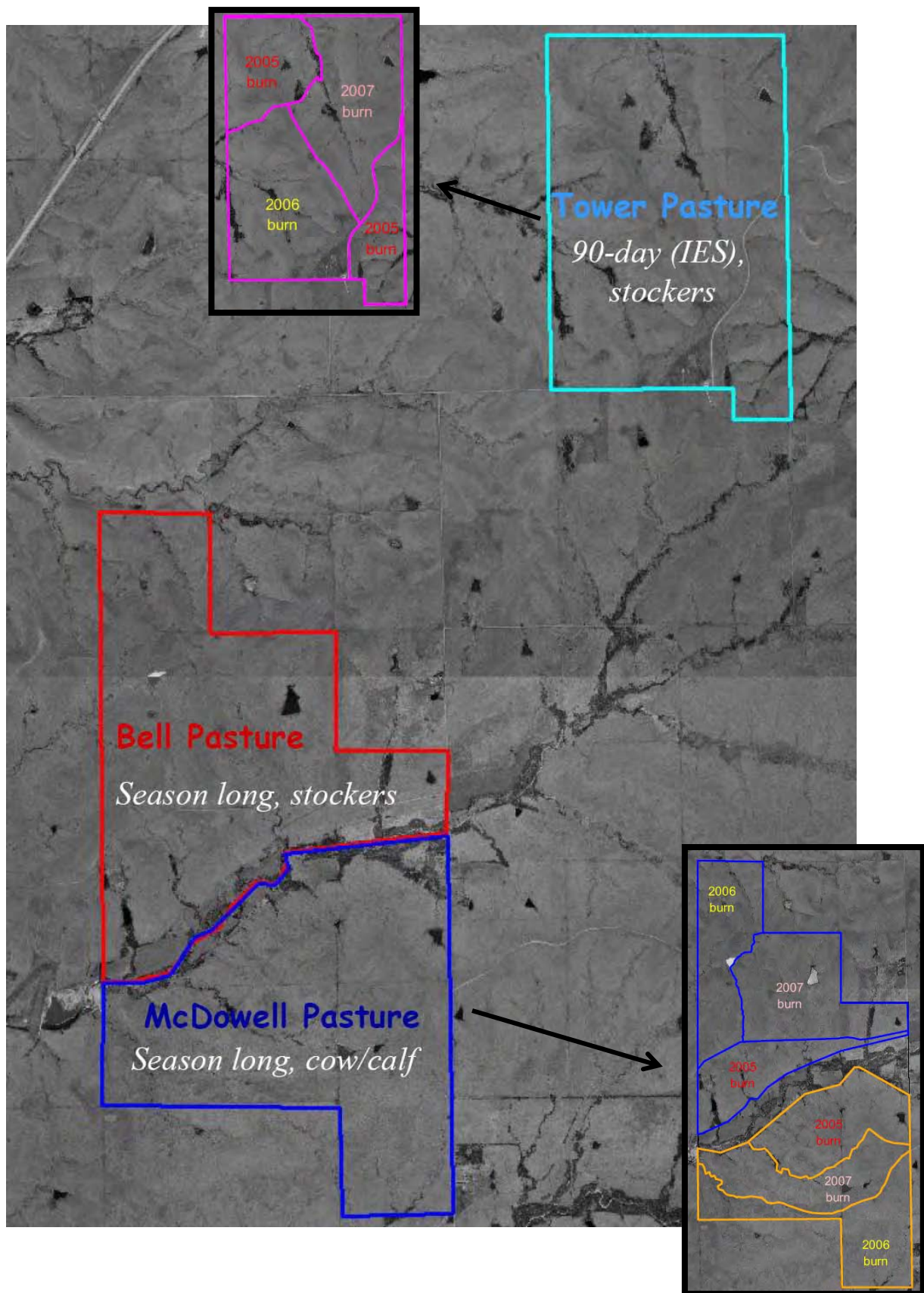
The Nature Conservancy has also encouraged producers to consider *rotational partial rest* as an option to enhance wildlife habitat while maintaining livestock production and performance. Rotational partial rest is not as “radical” of a concept as PBG but, rather, is a refinement to IES. Rotational partial rest is where a portion of a pasture or grazing unit is left unburned (e.g., one-third) instead of burning the entire acreage; in contrast, roughly two-thirds of a pasture is left unburned with PBG. Each year an unburned treatment is rotated to a different part of the pasture. The unburned area is partially rested because livestock will avoid unburned areas when tender, new growth is available.

Kansas and Oklahoma TNC staff and OSU partners have kicked off an outreach effort over the past several years that has included publications in scientific journals, range and wildlife management newsletters, and regional newspapers, as well as numerous workshops and tours with natural resource agency staff and ranchers.

LEGACY FUNDED PROJECTS

Homestead Ranch — In 2004, rancher Jane Koger began the Homestead Range Renewal Initiative (HRRI) on her ranch in Chase County, Kansas. HRRI was designed as an ecosystem approach to consider simultaneously biological diversity and grazing productivity. Ms. Koger’s HRRI advisory team – made up of representatives from the Homestead Ranch, U.S. Fish & Wildlife Service, The Nature Conservancy, NRCS, a Chase County rancher, and a Chase Co. youth partner – has met regularly to assist in planning, monitoring, and implementation of projects. At about the same time, she implemented PBG with a goal of increasing structural heterogeneity over 2,700 acres (on three pastures) of her ranch. The Conservancy entered into a cooperative agreement with Ms. Koger to utilize Legacy Program funds to help with costs associated with implementing the practice. Ms. Koger agreed to reduce overall stocking rates (based on NRCS standards) by 13.8%, from 2,347 Animal Unit Months (AUMs) to 2,040 AUMs, each year for 3 years commencing at the start of the 2004 grazing season. Legacy funds were also used to provide a cost share for the first year’s burn. Since 2004, approximately one-third of each pasture has been burned every year on a rotational basis.

The map below shows the burning rotation and grazing regime she has followed in the three pastures. This burning scheme, used in conjunction with grazing, has created a unique shifting mosaic of grassland structural stages, which has been shown to provide habitat for a broader range of grassland species, such as the greater prairie-chicken and Henslow's sparrow. PBG is also providing larger fuel loads needed to conduct hot burns to help control woody encroachment. Ms. Koger plans to continue using PBG in the future without further incentives to manage her property.



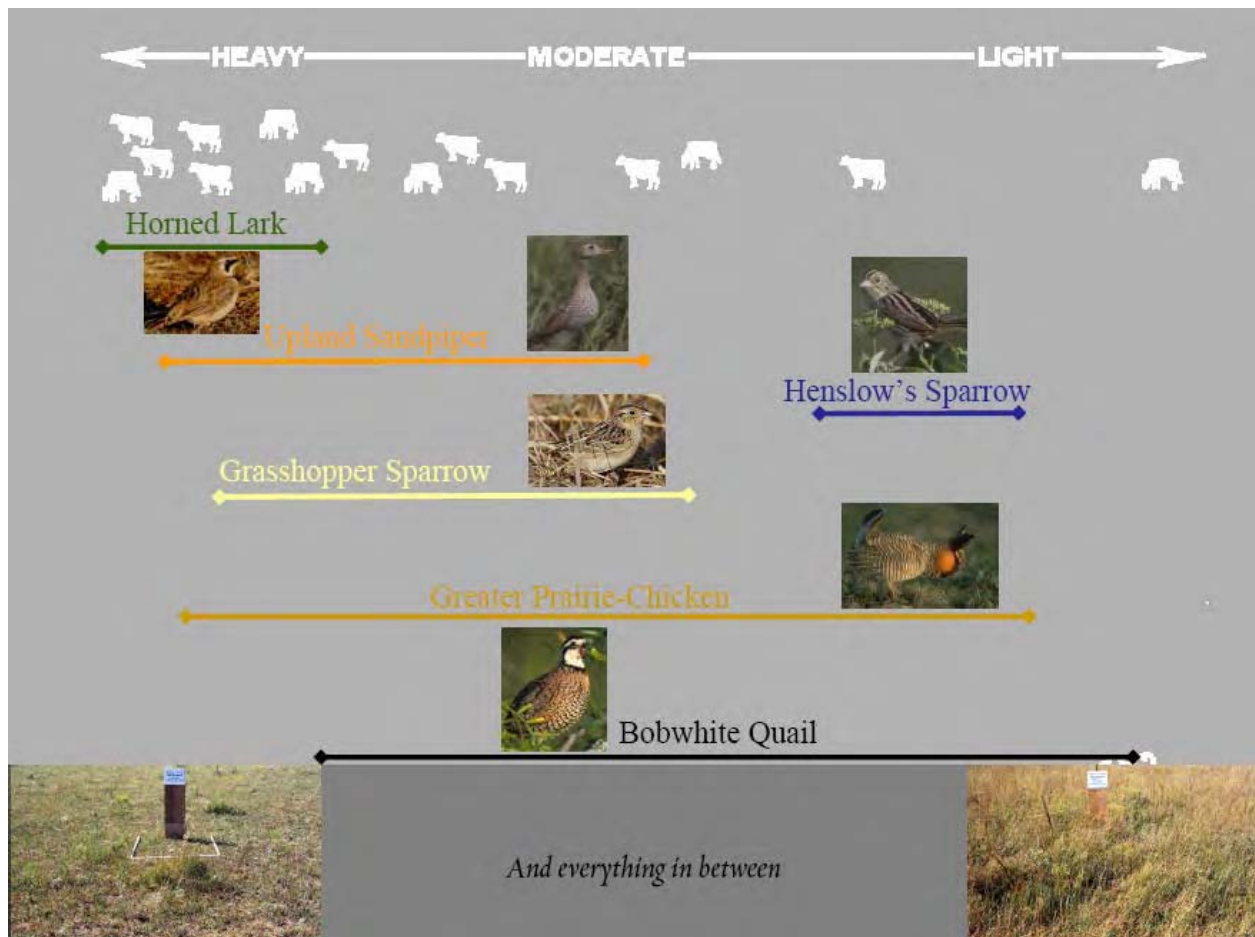
Monitoring activities on the Homestead Ranch have included annual breeding bird surveys at the end of May; fixed-point photography at six locations in each of the three pastures (two sample points in each of three burn sectors per pasture in May, July and September; see Exhibit A); cattle production rate data collection; and other photography and mapping. Although conclusive data will not be available until the last phase of the study is completed in 2010, preliminary findings are encouraging.

The second spring breeding bird survey in May 2005 showed an increase in eastern meadowlark, grasshopper sparrow, and greater prairie-chicken. Most encouraging was the first-time appearance of Henslow's sparrow ($n = 11$). While few ($n = 5$) Henslow's have been noted during subsequent May surveys (in 2008), a number of individuals exhibiting territorial behavior have been observed later in the season (e.g., August); the influx of Henslow's later in the season has also been noted at other Flint Hills sites. Below is a summary of the bird surveys that have been conducted on the ranch since 2004.

HOMESTEAD RANGE RENEWAL INITIATIVE: BREEDING BIRD SURVEY SUMMARY (2004-2008)

	28-May	27-May	19-May		18-May		30-May		TOTAL	%
	Bell	Bell	Tower	Bell	Tower	Bell	Tower	Bell		
	2004	2005	2006		2007		2008			
Eastern Meadowlark	27	69	47	34	67	73	92	64	473	29.7%
Grasshopper Sparrow	43	58	21	24	39	41	55	54	335	21.1%
Dickcissel	73	41	11	30	1	46	3	32	237	14.9%
Upland Sandpiper	44	20	5	10	20	12	10	18	139	8.7%
Cowbird	8	12	10	14	8	12	4	18	86	5.4%
Red-Winged Blackbird	6	6	12	2	4	5	7	8	50	3.1%
Greater Prairie Chicken	7	9	8	1	3	6	0	1	35	2.2%
Bobwhite	0	0	2	7	5	10	4	1	29	1.8%
Nighthawk	2	1	1	7	7	0	4	2	24	1.5%
Barn Swallow	2	10	1	3	1	0	0	3	20	1.3%
Crow	0	9	1	2	3	0	2	0	17	1.1%
Henslow's Sparrow	0	11	0	0	0	0	2	3	16	1.0%
Killdeer	0	0	3	0	6	2	0	0	11	0.7%
Brown Thrasher	1	1	1	3	2	0	1	1	10	0.6%
Great-Crested Flycatcher	2	1	0	0	0	3	0	3	9	0.6%
Eastern Bluebird	2	2	5	0	0	0	0	0	9	0.6%
Cardinal	1	0	0	1	0	4	0	0	6	0.4%
Field Sparrow	0	0	1	2	0	0	1	2	6	0.4%
Tufted Titmouse	2	1	0	1	0	2	0	0	6	0.4%
Scissor-Tailed Flycatcher	0	0	5	1	0	0	0	0	6	0.4%
Lark Sparrow	1	0	0	0	1	0	3	0	5	0.3%
Canada Geese	0	0	0	2	2	0	0	1	5	0.3%
Mourning Dove	1	2	0	1	1	0	0	0	5	0.3%
Mockingbird	0	2	3	0	0	0	0	0	5	0.3%
Great-Tailed Grackle	1	0	0	0	1	0	0	2	4	0.3%
Carolina Wren	0	2	0	0	0	1	0	1	4	0.3%
Bobolink	0	0	0	4	0	0	0	0	4	0.3%
Yellow-Billed Cuckoo	2	2	0	0	0	0	0	0	4	0.3%
Brewer's Blackbird	0	0	0	0	0	0	3	0	3	0.2%
Goldfinch	2	0	0	0	0	0	0	1	3	0.2%
Red-Bellied Woodpecker	1	1	0	1	0	0	0	0	3	0.2%
Baltimore Oriole	0	0	0	0	0	2	0	0	2	0.1%
Common Yellow-Throat	0	0	0	0	0	2	0	0	2	0.1%
Indigo Bunting	0	0	0	0	0	0	0	2	2	0.1%
Bluejay	0	1	0	0	1	0	0	0	2	0.1%
Common Grackle	0	1	0	0	0	0	1	0	2	0.1%
Kingbird	0	0	1	0	0	0	1	0	2	0.1%
Eastern Wood Peewee	0	2	0	0	0	0	0	0	2	0.1%
Belted Kingfisher	0	0	0	0	0	0	1	0	1	0.1%
Blue-gray gnatcatcher	0	0	0	0	0	0	0	1	1	0.1%
Turkey Vulture	0	0	0	0	0	0	0	1	1	0.1%
Phoebe	0	1	0	0	0	0	0	0	1	0.1%
Purple Martin	0	0	0	1	0	0	0	0	1	0.1%

“One of the best things about PBG,” says Jane, “is that each year you burn the patch that hasn’t been burned in three years. That means the grass has gotten a rest and you get a better burn. It looks like patch-burning is good for the grass, good for the cattle, and good for the birds.” Below is a graphic that shows the range of habitat that can be simultaneously provided within one pasture using PBG. She also admits that patch burning is a little harder to do. “You really have to control your fire. It takes more time, more equipment, and lots of help from your neighbors.”

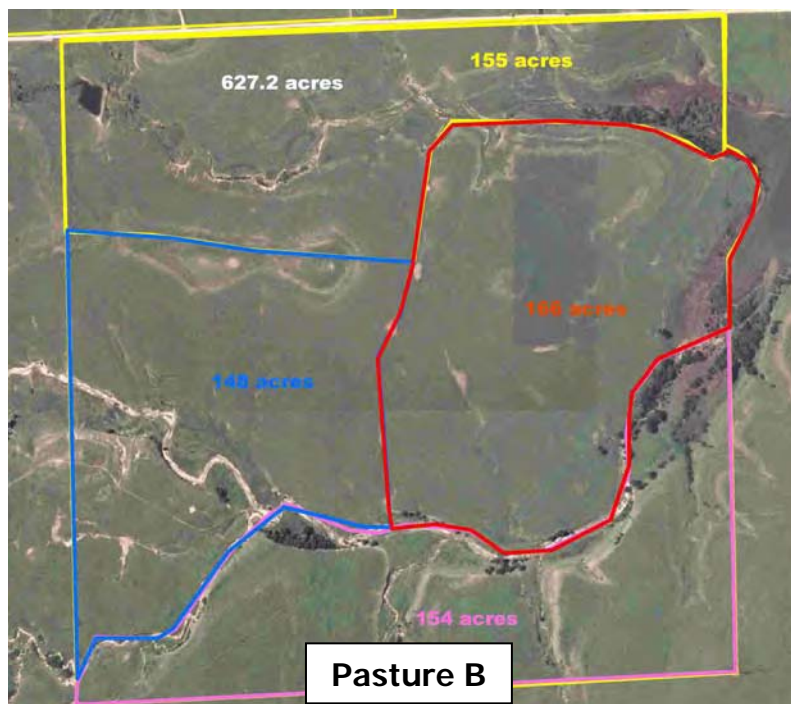
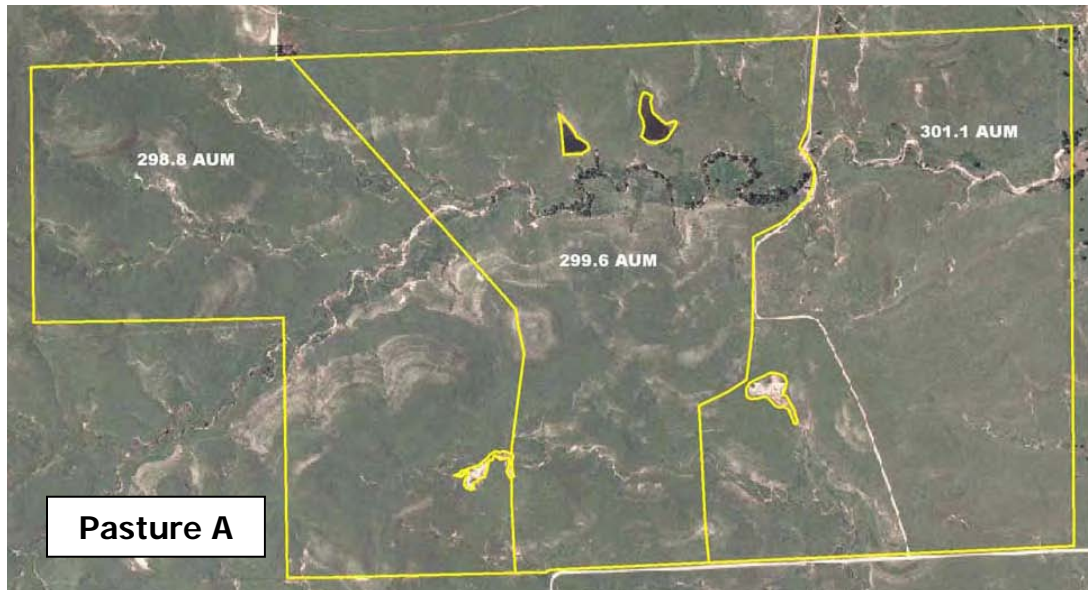


The Homestead Ranch’s patch-burn grazing experiment has gotten the attention of many ranchland enthusiasts and experts. She and her partner, Marva Weigelt, regularly give tours to others interested in managing rangelands to meet the needs of both wildlife and livestock. They have also been active in PBG outreach. The Homestead Ranch’s PBG experiment was featured in the January 5, 2005, NRCS’s This Week, an online report on the conservation of Private lands. It was also been featured on the Environmental Defense Fund website (<http://www.edf.org/article.cfm?contentID=5701&campaign=117>). Marva Weigelt recently published a paper about the project in Ecological Restoration, titled *Managing for Grassland Diversity: A Study on Grazing-Fire Interactions in the Flint Hills* (http://www.republicofgrass.com/Ecological_Restoration_3-2006.pdf). Below is a summary

of the PBG outreach that the Homestead Ranch has provided. For more information about the Homestead Ranch, go to: <http://www.republicofgrass.com/HRRI.html>

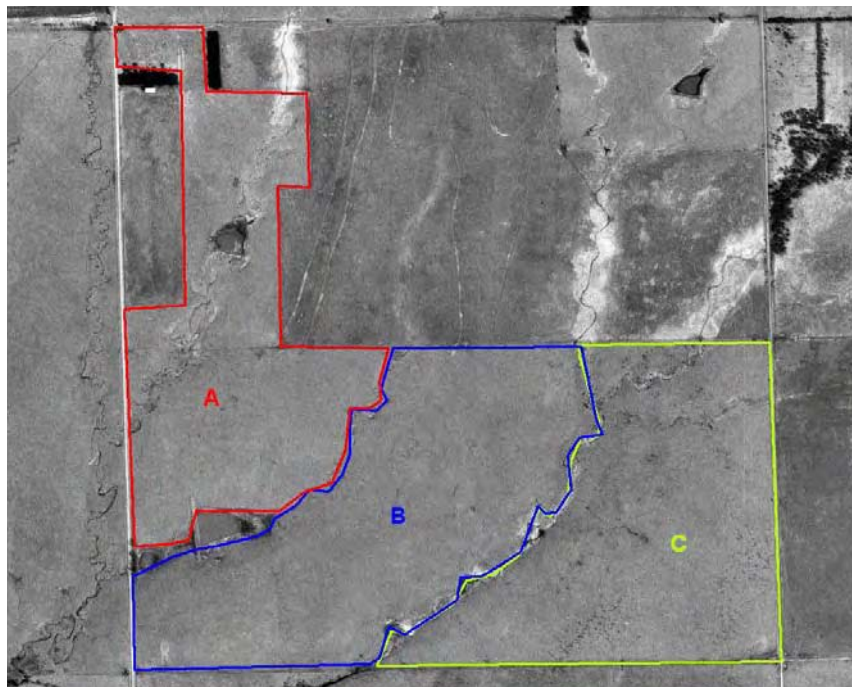
Summary of PBG outreach provided by the Homestead Ranch		
Date	Title or Topic	Event or Publication
January 5, 2005	<i>Kansas Patch Burning</i>	NRCS This Week, Your Report for Conservation on Private Lands (on-line edition)
April 2005	<i>Patch-burn grazing program</i>	Wheat State Agronomy Club Tour on the ranch
June 2005	<i>Patch-burn grazing program</i>	Kansas Rural Center Wildflower Tour on Homestead Ranch
August 2005	<i>Grazing Management with Patch-Burn Grazing</i>	Cowboy Coffee Talks: presentation sponsored by USDA at Cambridge, KS
March 2006	<i>Managing for Grassland Diversity: A Study on Grazing-Fire Interactions in the Flint Hills</i>	Marva L. Weigelt, Ecological Restoration, Volume 24, Number 1, p. 41
October 2006	<i>Homestead Range Renewal Initiative, Patch-Burning/Patch-Learning</i>	Patch-Burn Grazing Working Group annual meeting, Tallgrass Prairie National Preserve, Strong City, Kansas
December 14, 2006	<i>Kansas Cattle Rancher Becomes Steward of the Grass</i>	Marva L. Weigelt, Environmental Defense Fund Center for Conservation Incentives, print and e-newsletter editions
March 2007	<i>Ranching is For the Birds</i>	Marva L. Weigelt, Matfield Green Community Newsletter
June 1, 2007	<i>Wide Open Spaces: Rancher works to preserve native pasture for cattle, wildlife</i>	Brandy Nance, Emporia Gazette, Emporia, Kansas (picked up by Associated Press and also appeared in Lawrence Journal-World, Topeka Capital Journal and Garden City Telegram)
October 2007	<i>Homestead Range Renewal Initiative Update</i>	Patch-Burn Grazing Working Group annual meeting, Nevada, Missouri
January 2008	<i>Redefining the Bottom Line: Ranching for Diversity</i>	Heterogeneity-based techniques symposium, Society for Range Management Annual Meeting, Louisville, Kentucky
June 22, 2008	<i>Roundup nets variety of butterfly species</i>	Michael Pierce, Wichita Eagle, print and online editions
July 2008	<i>From Beef to Butterflies: Enhancing Diversity in the Tallgrass Prairie</i>	Plants & Pollinators Symposium, Soil & Water Conservation Society Annual Meeting, Tucson, Arizona
September 2008	<i>Homestead Range Renewal Initiative Update</i>	Patch-Burn Grazing Working Group Annual Meeting, Aurora, Nebraska
October 2008	<i>Thinking Outside the Cow: Patch-Burn Grazing in the Flint Hills</i>	New Approaches to Managing Semi-Arid Grasslands, Cheyenne, Wyoming
October 2008	<i>Patch-Burn Grazing</i>	Poster Presentation with NRCS, Farming with Grass, Soil & Water Conservation Society meeting, Oklahoma City, Oklahoma
November 2008	<i>Introduction to Patch-Burn Grazing</i>	Tallgrass Legacy Alliance Lunch & Learn

Browning Ranch — The Browning Ranch in Greenwood County, Kansas, has implemented PBG, with the financial assistance of Legacy program funds, on two native prairie pastures totaling over 1,700 acres: 1,120 acres in Pasture A and 612 acres in Pasture B (see below). Pasture A has been stocked using NRCS recommended stocking rates. Pasture B was stocked at approximately 72% of the NRCS recommended stocking rate. One-third of pasture A is burned on a rotational basis each year, whereas one-fourth of Pasture B is being rotationally burned. In each pasture, cattle (stocker cattle) have access to the entire parcel.



Monitoring of the two patch-burned pastures on the Browning Ranch has included bird surveys in May as well as photopoints (see Exhibit B) to examine native vegetation responses. The Henslow's sparrow has been noted each year of the survey. Bird data will be shared as it becomes available; it is currently managed by Mr. Jim Minnerath of the USFWS.

Vestring Ranch — The Conservancy entered into a three-year cooperative agreement with the Vestring Ranch in 2007 to implement patch-burn grazing over 375 acres of native tallgrass prairie rangeland in Butler County, Kansas. Below is an aerial photo of the property showing the pasture divisions where one-third of the acreage will be burned on a rotational basis. Areas C and B were burned in 2007 and 2008, respectively. Stocking is at or near NRCS recommended stocking rates, based on soil type and range condition, and consists of short season grazing (~90 days) of stocker cattle; however, the cooperator has the option of using full season cattle in years 2008 and 2009. Cattle have access to all of the acreage throughout the pasture. A one-time payment for the three year rotational burning/grazing plan was based on a 100% cost share for implementation of the patch burn in year one - 2007 (i.e., 375 acres * \$8 ac.^b).



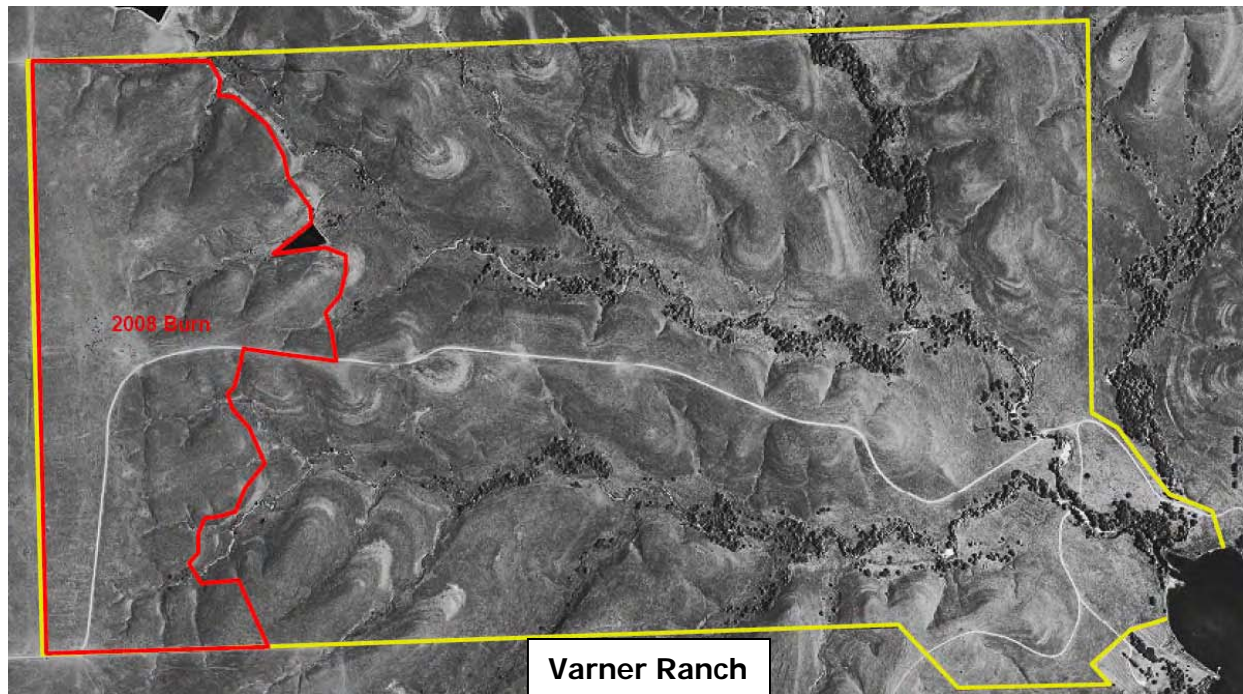
There has not been any monitoring of the property, but we hosted a tour of the property during a Tallgrass Legacy Alliance meeting during the fall of 2007. The landowners (Vestring family) have indicated that they are satisfied with PBG, but it is too early to tell if they will continue with the practice after 2009.

^b Custom burn rate in Kansas, based on NRCS (USDA) specs, is \$8 per acre.

Collinge Ranch — In 2008, Mr. Mike Collinge implemented rotational partial rest to enhance wildlife and range health on 452 acres of his mother's property (Lola Collinge) in Greenwood County near Eureka, Kansas (N½ & SE¼ of Section 25, Township 25 South, Range 10 East). Approximately two-thirds of the total acreage will be burned each year on a rotational basis. Cattle will have access to all of the acreage. The Conservancy will consult with the Cooperator each year to ensure the plan is followed. Mr. Collinge has already implemented this year's burn, and has agreed to continue rotational partial rest through to at least 2010. He has also agreed to follow NRCS recommended stocking rates, based on an NRCS estimate of 393.8 Animal Unit Months. There has not been any monitoring or outreach on the property to date, but Mr. Collinge has promised to keep accurate records for demonstration purposes. Mr. Collinge is a prominent rancher, so his decision to implement rotational partial rest could have significant exposure. We intend to host a Tallgrass Legacy Alliance field trip to the property in either 2009 or 2010.



Shadow Valley Ranch — In 2008, Mr. Sterling Varner implemented PBG on approximately 1,180 grazable acres of native, tallgrass prairie (see below) located in Butler County, Kansas (in sections 8 & 17, all in Township 24 South, Range 8 East). Mr. Varner has agreed to patch burn the property (approx. one-third of the pasture each year on a rotational basis), and follow BLM's (Bureau of Land Management) recommended stocking rate of 172 wild horses. It is anticipated that PBG will help entice the wild horses to graze more evenly over the entire pasture over the course of the 3-year rotation. Currently, horses are more heavily utilizing the uplands, with very little use in the bottoms.



FINAL THOUGHTS *and* CONCLUSIONS

Besides providing habitat enhancements for grassland birds and other wildlife, PBG reduces the need for cross fencing to enhance grazing distribution. The Homestead Ranch was able to remove nearly 3 miles of cross fencing (see Exhibit A), and 1.7 miles of cross fencing was removed when initiating the PBG project at the Tallgrass Prairie National Preserve. Removal of cross fences may reduce potential negative wildlife impacts that have been attributed to livestock fencing. Wolfe et al. (2003) suggested that fragmentation due to fences – although not necessarily detected in traditional landscape studies – may be a greater factor than what has previously been thought. They reported that fences were the most significant contributor of lesser prairie-chicken mortality in a study done in Oklahoma. For the 128 known causes for mortality, 51 (39.8%) were attributed to fence collisions (see below figure), 37 (28.9%) were attributed to raptor predation, 33 (25.8%) were attributed to mammalian predation, 6 (4.7%) were attributed to powerline collisions, and 4 (3.1%) were attributed to vehicle collisions.

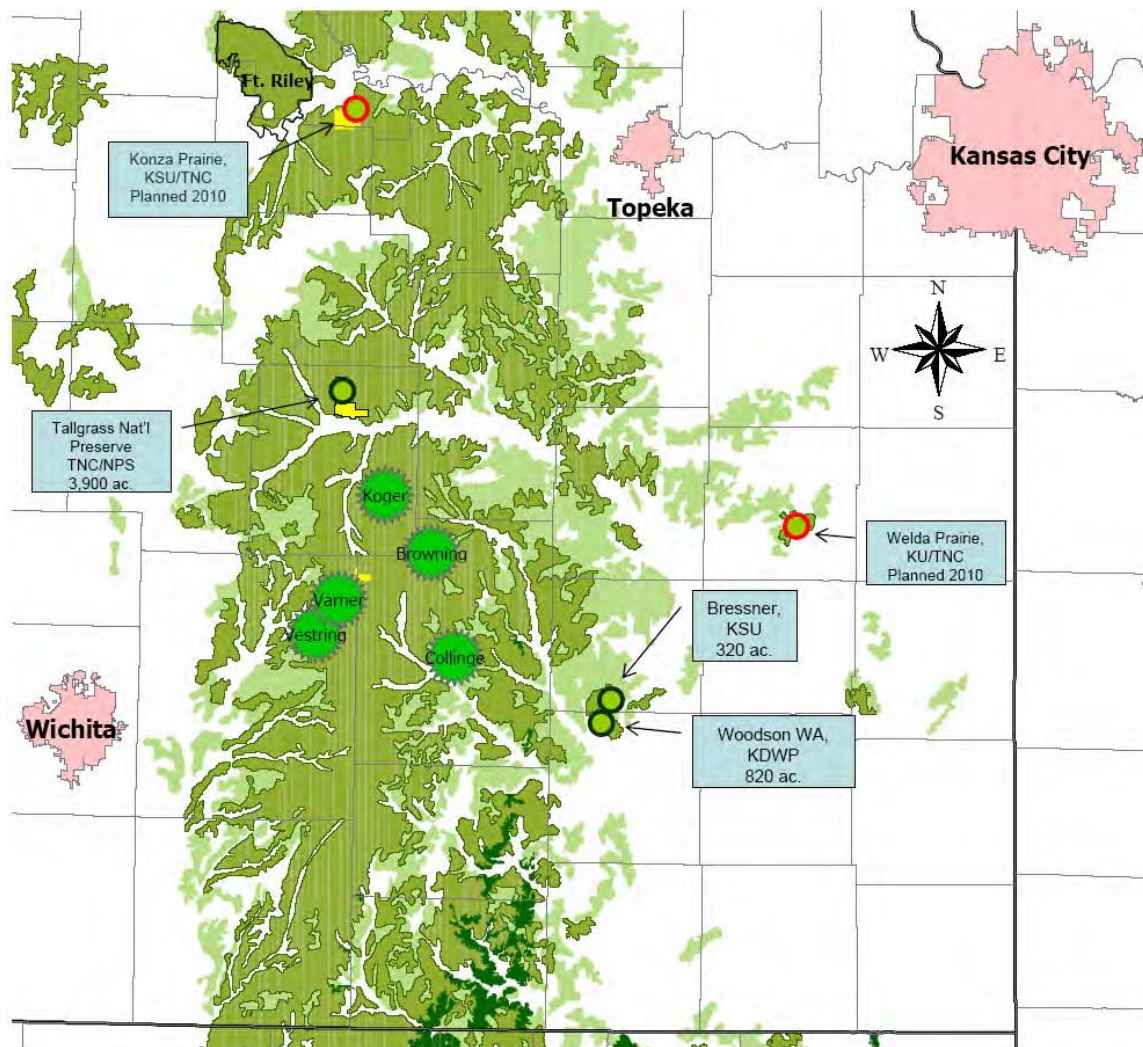


Photos showing prairie chicken mortality as a result of fences in Oklahoma.

Wolfe et al. also examined mortality at a New Mexico site, and found that for the 132 known mortality causes of radioed birds, 54 (40.9%) of the mortalities were attributed to raptor predation, 43 (32.6%) were attributed to mammalian predation, and 35 (26.5%) were attributed to fence collisions. The differences between the sites, especially in regard to fence, power line, and vehicle collisions is likely due to the greater level of fragmentation at the Oklahoma site (Patten et al. 2005). The Oklahoma study site was composed largely of square mile sections, usually with county roads separating adjacent sections, and often fenced in $\frac{1}{4}$ section pastures or row crops. However, the New Mexico study site consisted of much larger pastures, upwards of four square miles, with scattered irrigated crop circles. Thus, the Oklahoma site was considerably more fragmented and included a higher density of fences, roads, and power lines. In fact, when fence, power line, and vehicle collisions are removed from the analysis, predation patterns are virtually identical between study sites (52.9% raptor, 47.1% mammal in Oklahoma, and 55.7% raptor, 44.3% mammal in New Mexico). A review of other grouse predation studies in North America show similar patterns (Don Wolfe, G.M. Sutton Avian Research Center, personal communication).

Legacy program funds have helped initiate 6,477 acres of innovative burning/grazing practices in the Flint Hills. Besides enhancing wildlife, particularly grassland birds, the enrolled projects have resulted in extensive outreach, particularly for patch-burn grazing. Since the initiation of the first project (Homestead Ranch), there has been much interest in PBG. For example, there is now a Patch-Burn Grazing Working Group, which has a Listserve to facilitate discussion.

There has also been additional acreage placed under PBG management. The Agronomy Department at Kansas State University is now researching PBG on 320 acres at their Bressner property in Woodson County. Nearby, the Woodson Wildlife Area has implemented PBG on an 820-acre pasture using full season cows. The Nature Conservancy has also initiated PBG on nearly 3,900 acres of their Tallgrass Prairie National Preserve in Chase County. Two additional sites are expected to begin PBG in 2010: at Konza Prairie and Welda Prairie (Anderson County). Below is a map showing all of the known PBG projects in Kansas, both planned and implemented.



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Exhibit A – Fixed photo points on Homestead Ranch

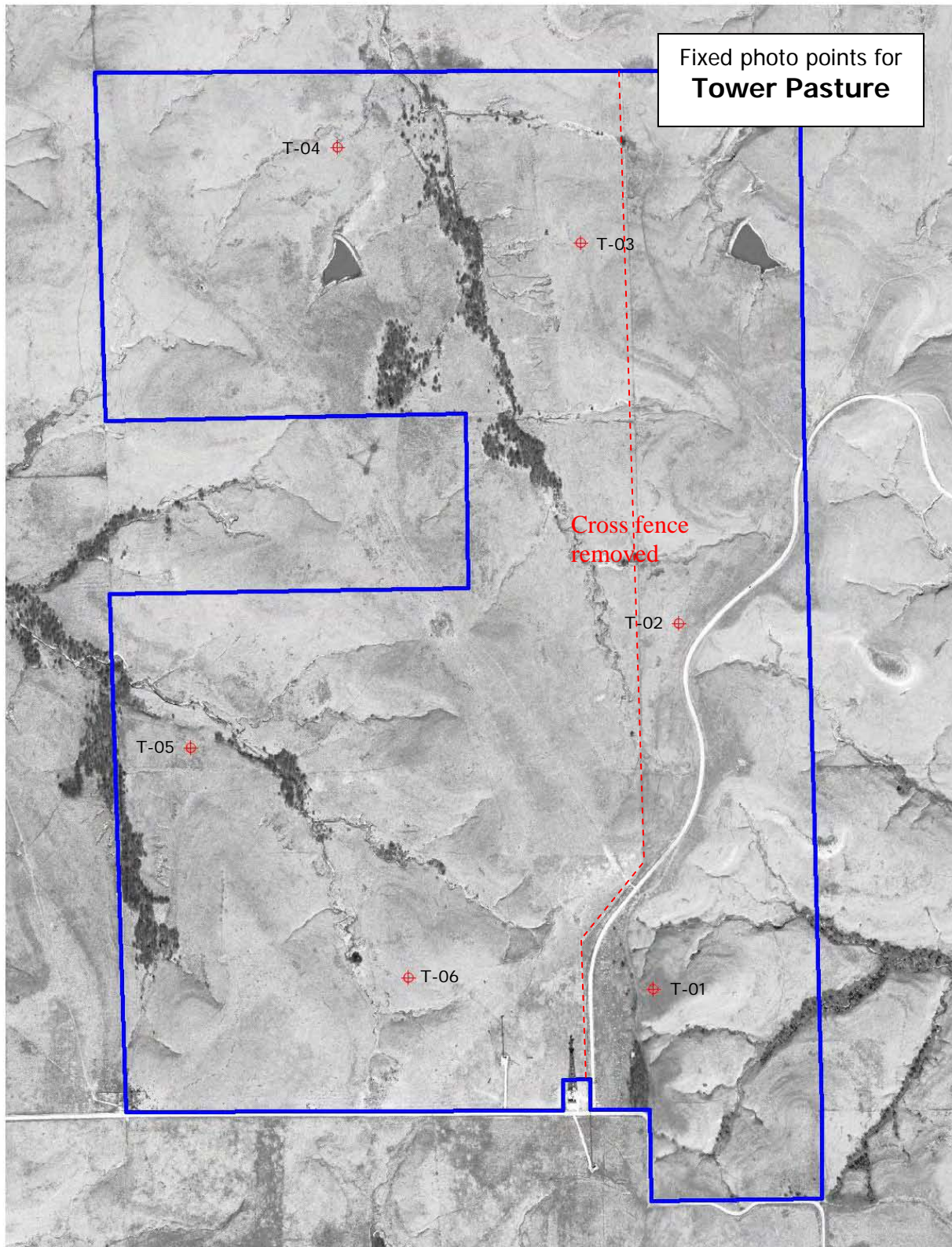


Exhibit A – *Continued*

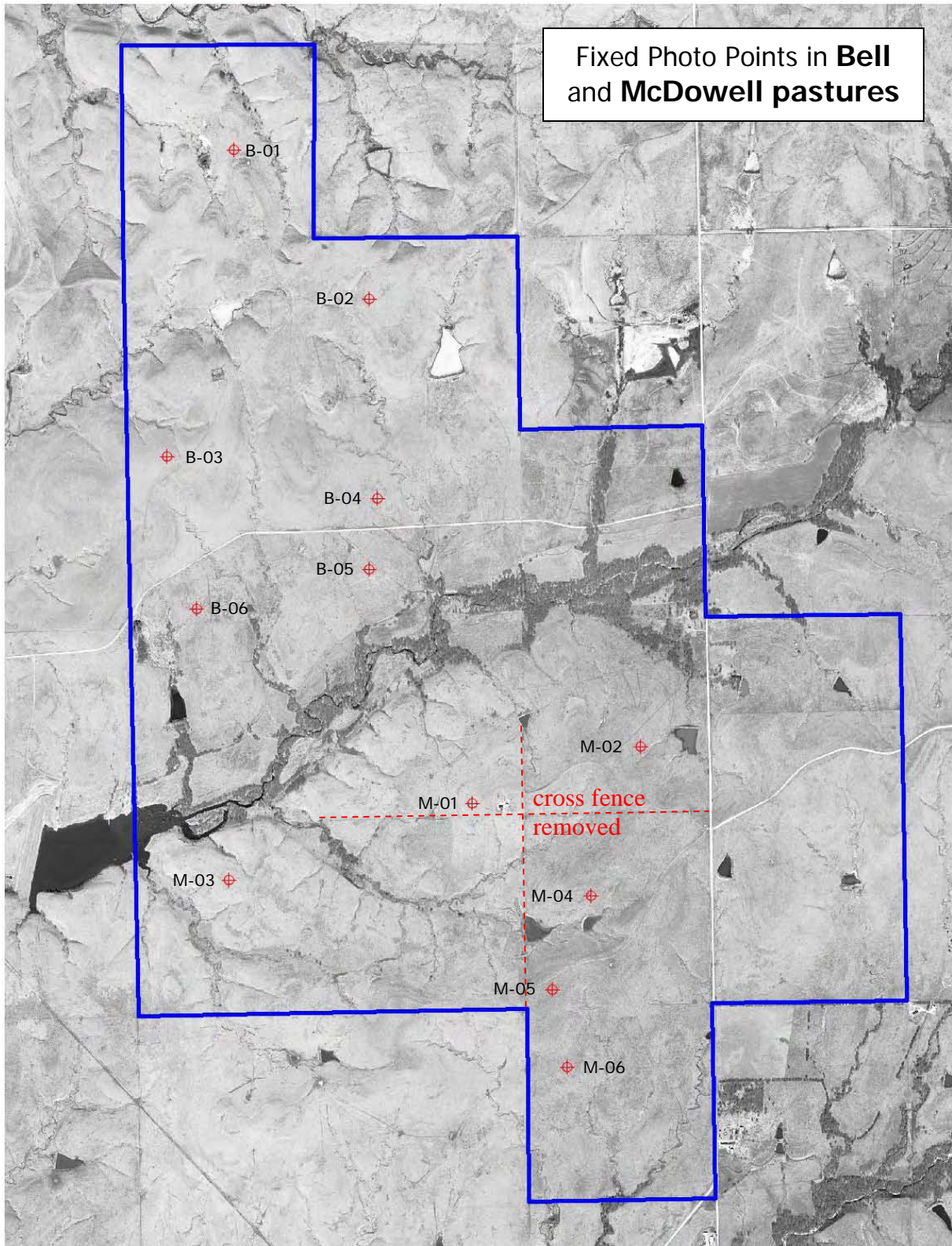
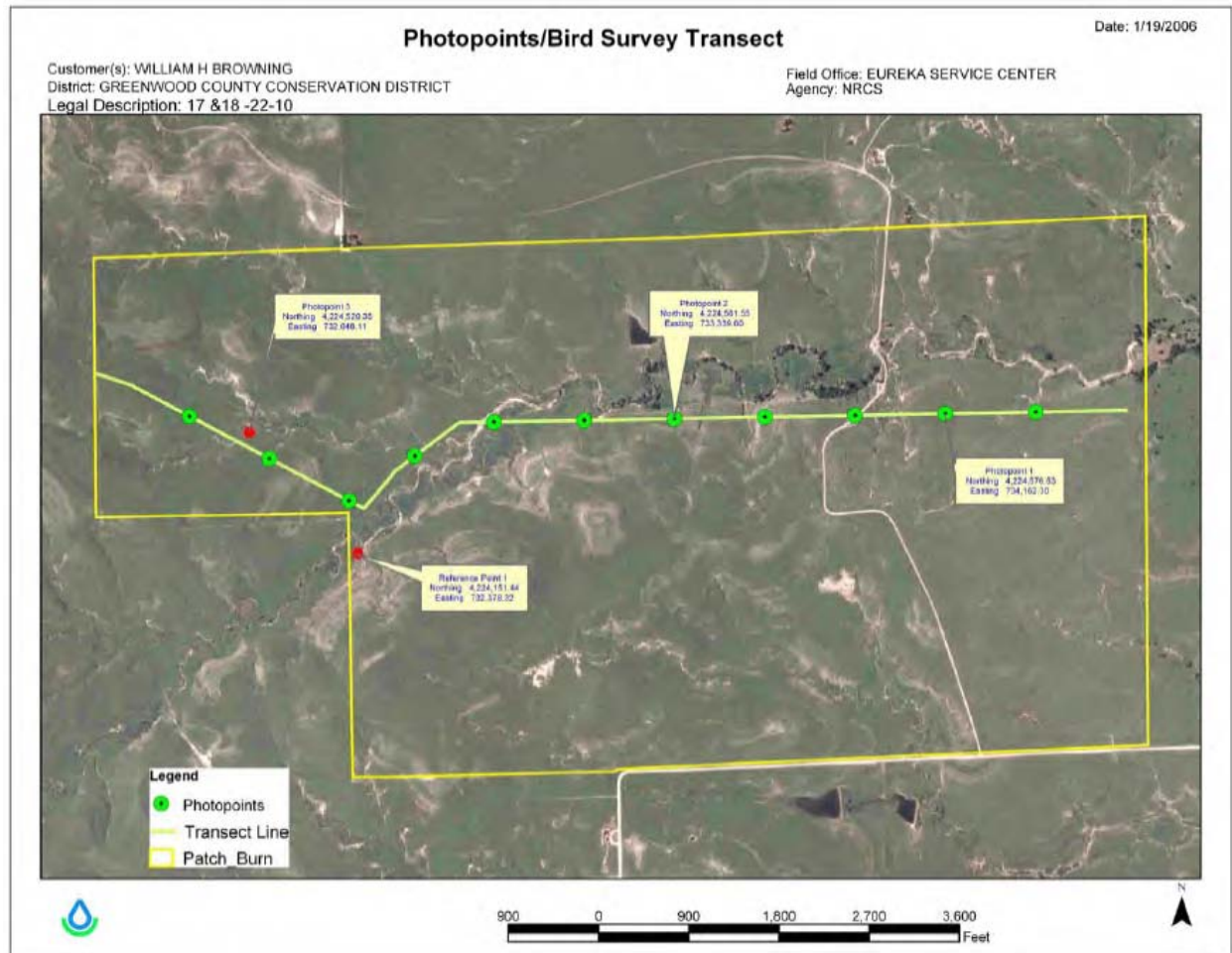


Exhibit B – Fixed photo points on Browning Ranch



7-06pt1N



7-06pt1E

Exhibit B – *continued*



7-06pt1S



7-06pt1W



7-06pt1Nv



7-06pt1Ev



7-06pt1Sv



7-06pt1Wv

Exhibit B – *continued*



7-06pt2N



7-06pt2E



7-06pt2S



7-06pt2W



7-06pt2Nv



7-06pt2Ev

Exhibit B – *continued*



7-06pt2Sv



7-06pt2Wv



7-06pt3N



7-06pt3E



7-06pt3S



7-06pt3W

Exhibit B – *continued*



7-06pt3Ev



7-06pt3Nv



7-06pt3Sv



7-06pt3Wv



Reference pt 1



Burnline